Spicer® Drive Axles

SPICER®

DANA

Service Manual

Spicer® Drive Axles

AXSM-8663

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GENUINE SPICER SERVICE PARTS

Should an axle assembly require replacement component parts, it is recommended that Spicer Heavy Axle Service Parts be used. Spicer Heavy Axle Service Parts are manufactured under the same rigid specification as are original equipment axle components. This assures the customer who uses genuine Spicer service parts, maximum reliability for a Spicer Heavy Axle assembly. They may be obtained through your vehicle manufacturer.

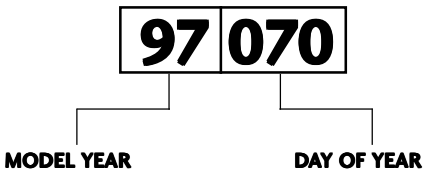
The use of non-original Spicer service parts may cause premature component failure and may void the warranty.

The items included in this book are currently being offered as service parts at the time of printing. The part numbers and illustrations are provided specifically for reference purposes only. Therefore, Spicer reserves the right to update this manual without notice or liability.

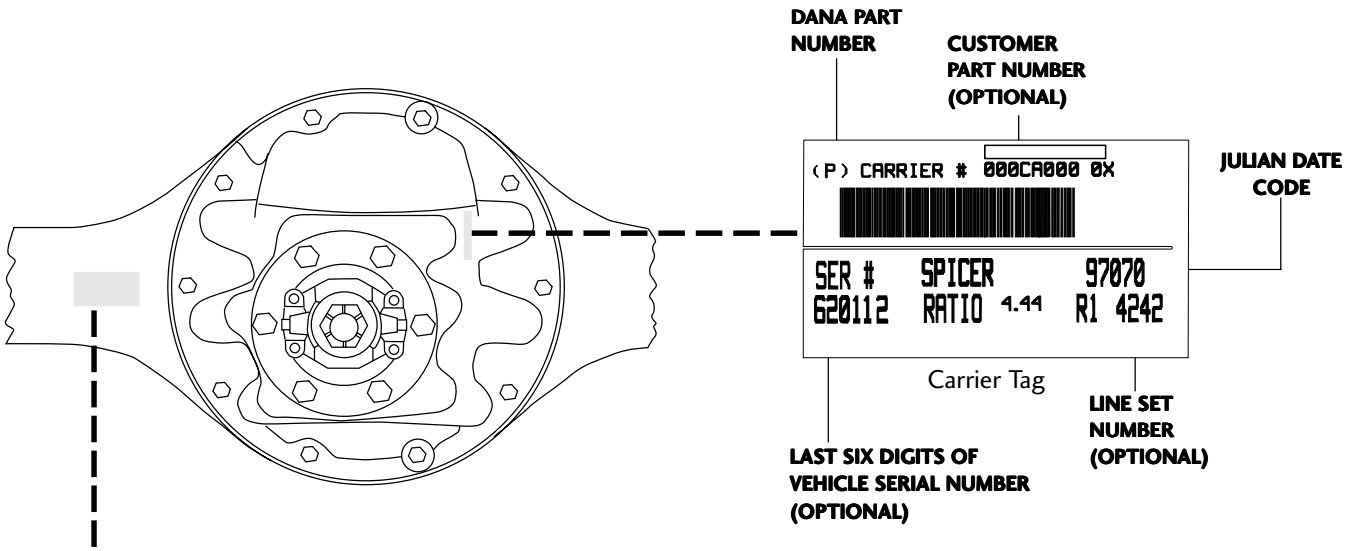
AXLE IDENTIFICATION

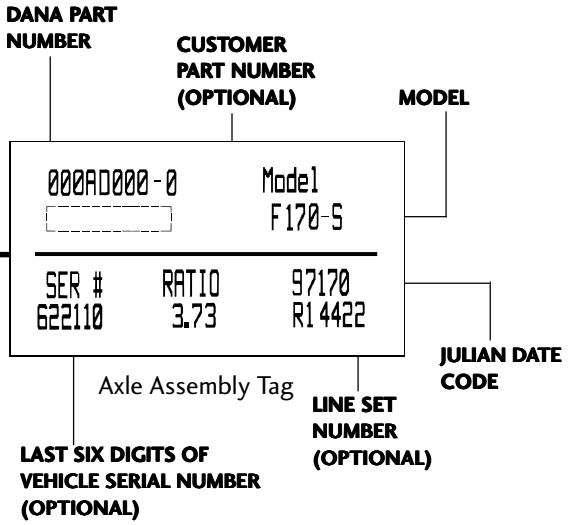
All axle assemblies are identified with two tags. One located on the differential carrier, and the other located on the right hand side of the axle housing.

JULIAN DATE CODE



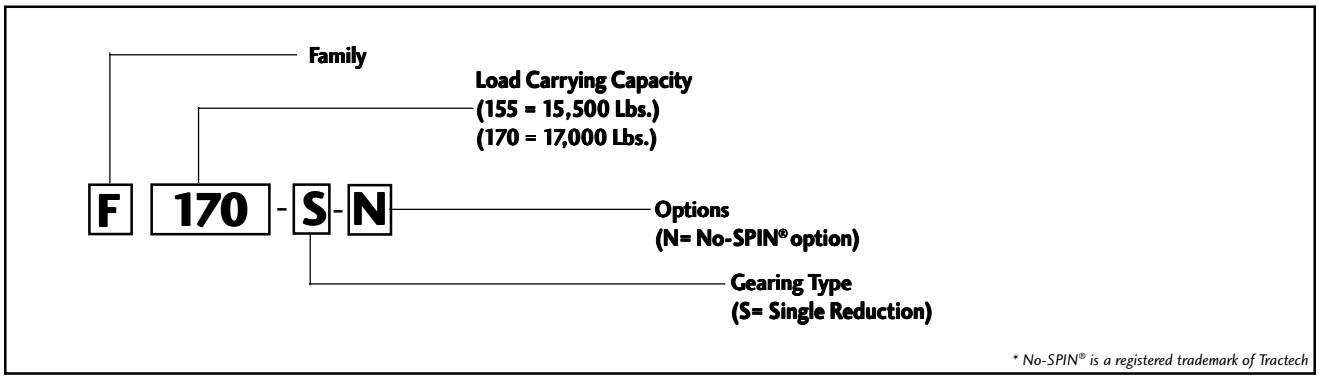
The differential carrier tag contains the following: Dana part number, julian date code, and ratio. Optional items include customer part number, line set number, and the last six digits of the vehicle serial number.


DANA PART NUMBER
CUSTOMER PART NUMBER (OPTIONAL)
(P) CARRIER # 000CA000 0X
JULIAN DATE CODE
SER # SPICER 97070
620112 RATIO 4.44 R1 4242
Carrier Tag
LINE SET NUMBER (OPTIONAL)
LAST SIX DIGITS OF VEHICLE SERIAL NUMBER (OPTIONAL)



The axle assembly tag contains the following items: Dana part number, julian date code, axle model, and ratio. Optional items include customer part number, line set number, and the last six digits of the vehicle serial number.

MODEL IDENTIFICATION NUMBERING SYSTEM



GEAR SET IDENTIFICATION

Manufacturer's Date- Date gear set was made.

Spicer Trademark- Dana Diamond and location of manufacturing facility.

029GP100- Part number of pinion. (TYPICAL)

029GR107- Part number of ring gear. (TYPICAL)

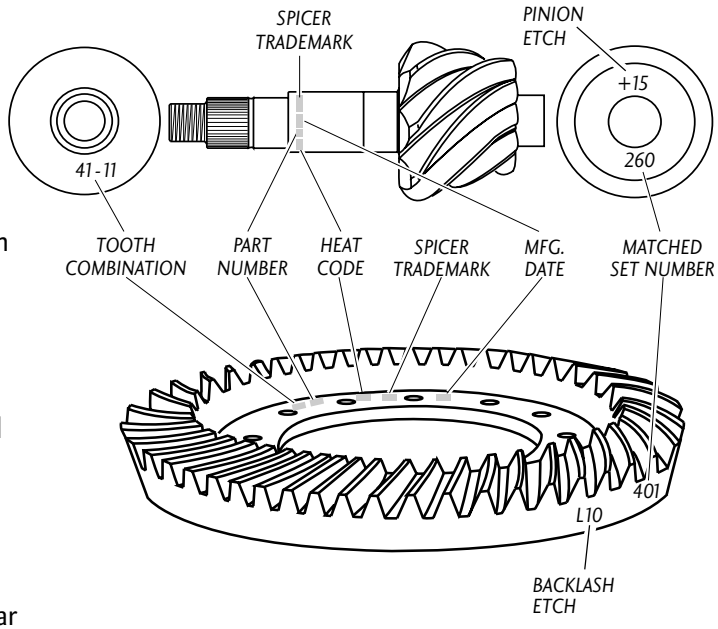
Tooth Combination(i.e. 41-11)- Indicates the pinion has 11 teeth and the ring gear has 41 teeth which results in a 3:73:1 ratio.

Matched Set Number- Spicer ring gears and pinions are manufactured as matched sets. Both ring gear and pinion are marked with a corresponding number (i.e. 401), which identifies them as a matched set.

A gear set that does not have the same match set numbers should not be run together. If either ring gear or pinion require replacement, *a new matched set must be used.*

Backlash Etch- Indicates backlash setting for assembly.

Pinion Etch- Indicator for proper pinion position shim stack up. See Pinion Position Section.



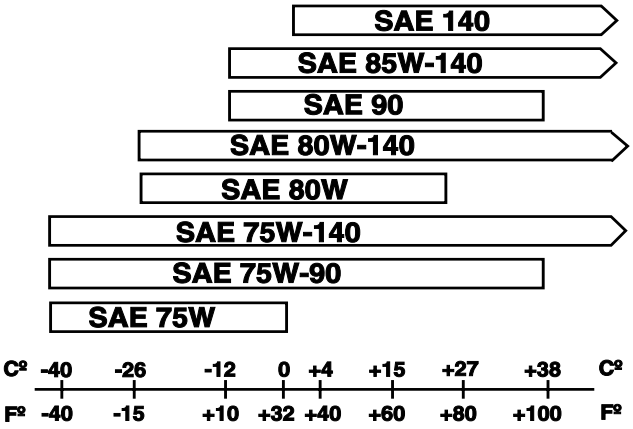
AXLE LUBRICANT RECOMMENDATIONS

To ensure proper lubrication and operating temperature, correct lubricants and lubricant levels must be obtained.

RECOMMENDED LUBRICANTS

Mineral or Synthetic based hypoid gear lubricants that meet or exceed military specification MIL-L-2105D, and API service classification GL-5, are the minimum requirements for use in Spicer Medium and Heavy Duty Drive Axles.

The table below indicates which SAE viscosities are recommended for various temperature ranges the vehicle will encounter.



Ambient Air Temperature

APPLICATION	PETROLEUM BASED		SYNTHETIC BASED**	
	MILES	INTERVAL	MILES	INTERVAL
On Highway	100,000	1 Year	250,000	3 Year
* Severe Service and On-Off Highway	50,000	1 Year	100,000	1 Year

* Severe service includes any applications operating at or near maximum GVW or GCW ratings. This includes normally wet or dusty environments, or consistent heavy load and low speed applications.

** Includes Semi-Synthetic blends that meet MIL-L-2105D specifications.

SERVICE

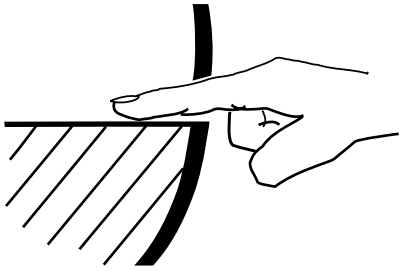
Recommended lubricant change intervals are dependent on the application and operating environment. The following chart should be used to establish proper change intervals.

SUBMERSION OR DEEP WATER FORDING

In the event the axle assembly should become submerged in water, particularly if over the vent or breather, it is recommended that the lubricant be drained and all parts be inspected for water damage and/or contamination. Reassemble the carrier to the housing and refill with specifed gear lubricant.

AFTER OVERHAUL OR CHANGE INTERVALS

Fill the axle assembly to the bottom of housing fill hole as shown in the illustration below. It is recommended that following an overhaul, each side of the axle be jacked up seperately to approximately six inches and held into position for one minute. This procedure will allow adequate lubricant to flow into the wheel ends and help eliminate the possibility of premature damage to wheel bearings and seals. Lower the vehicle to the floor and allow ten minutes for lube to return to normal level. Check and refill assembly to bottom of fill hole to replace the lubricant that was directed into the wheel ends.



NOTE: Lubricant close enough to the bottom of the fill hole to be seen or touched is not sufficient. Lubricant must be level with the fill hole.

GENERAL PRECAUTIONS

⚠ IMPORTANT

READ THIS SECTION BEFORE STARTING ANY SERVICE PROCEDURES

GENERAL AXLE DESCRIPTION

This manual covers maintenance and rebuild procedures for the Spicer F155-S and F170-S rear drive axle assemblies.

The Spicer Heavy Duty Single Reduction rear drive axle is a full floating axle assembly, with a hypoid gear carrier assembly, using a High Strength Low Alloy (HSLA) steel axle housing. The hypoid pinion is straddle mounted with two tapered roller bearings behind the pinion teeth for thrust and radial loads. A pilot bearing is located on the nose of the pinion for radial load. The differential itself uses four precision forged pinion mate gears, a forged cross, and precision forged side gears.

Safety glasses should be worn at all times when assembling or disassembling axles.

SAFTEY PRECAUTIONS

Proper service and repair of vehicle components is important to the safe and reliable operation of all motor vehicles. This applies particularly to driving axles such as the ones described in this manual. The procedures recommended and described in this manual are tested, effective methods for performing service operations. Follow each procedure closely, making use of both the text and illustrations. Some of these service procedures show the use of certain tools designed specifically for the operation being performed. They are shown as a preferred means of performing the operation. It is not practical to anticipate and advise the service trade of all possible alternative methods, and of all possible hazardous consequences that could occur.

Accordingly, anyone who uses a service procedure or tool different than shown must insure that their safety, and the vehicle's safety, will not be jeopardized by the service method selected.

END YOKES AND FLANGES

⚠ CAUTION: Hammering on end yokes can close in the bearing bores or misalign yoke lugs and result in early failures of journal needle bearings or other driveline components. Serious damage can also be done internally to the ring and pinion set or pinion bearings by hammering on external parts. End yokes or companion flanges should be removed or installed using the recommended methods outlined in this manual.

CLEANLINESS

Axle components should be steam cleaned prior to removal from the vehicle. Dirt is abrasive and will cause premature wear of otherwise serviceable parts.
Service personnel should use a wash tank for thorough cleaning of parts just prior to reassembly.

⚠ CAUTION

BRAKE LININGS CONTAIN NON-ASBESTOS FIBERS

BREATHING BRAKE DUST MAY BE HAZARDOUS TO YOUR HEALTH AND MAY CAUSE SERIOUS RESPIRATORY OR OTHER BODILY HARM.

AVOID CREATING DUST

DO NOT REMOVE BRAKE DRUM WITHOUT PROPER PROTECTIVE EQUIPMENT.

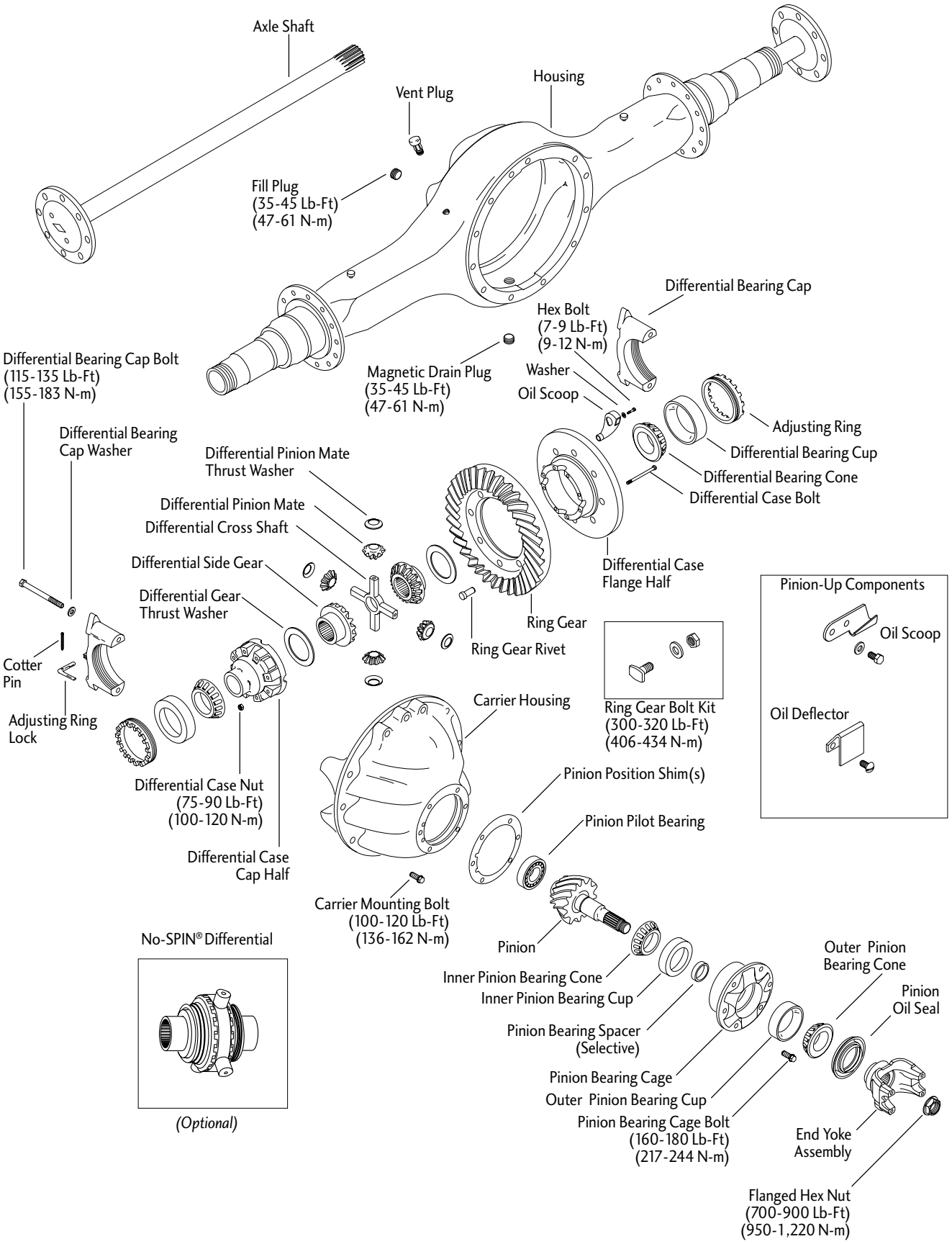
DO NOT WORK ON LININGS WITHOUT PROPER PROTECTIVE EQUIPMENT.

DO NOT REPLACE LININGS WITHOUT PROPER PROTECTIVE EQUIPMENT.

DO NOT ATTEMPT TO SAND, GRIND, CHISEL, FILE, HAMMER OR ALTER BRAKE LININGS IN ANY MANNER WITHOUT PROPER PROTECTIVE EQUIPMENT.

FOLLOW 0.S.H.A. STANDARDS FOR PROPER PROTECTIVE DEVICES TO BE USED WHEN WORKING WITH BRAKE MATERIALS.

AXLE COMPONENTS



REMOVAL OF DIFFERENTIAL CARRIER FROM AXLE HOUSING

NOTE: Steam clean axle assembly.

1. Block wheels.
2. Remove axle housing drain plug and drain lubricant.
3. Disconnect drive shafts at the rear U-joint.

NOTE: If end yoke and/or seal is to be replaced, loosen yoke nut at this time.

4. Remove axle shaft flange nuts.
5. Hold a large brass drift or a brass hammer against the center of the axle shaft flange. Strike the drift with sharp blows from a large hammer or sledge until the axle shaft separates from the hub.

⚠ CAUTION: Do not strike the flange directly with a steel hammer or sledge. This may crack and splinter material, possibly causing serious or fatal injury. Do not pry or chisel axle flange away from hub or damage to sealing surfaces could occur.

6. Remove axle shafts.
7. Support the differential carrier assembly on a roller jack. Secure as necessary to prevent it from falling off the jack when removed from the housing.
8. Use a breaker bar to loosen the differential carrier-to-housing mounting bolts. Remove all bolts except top two. These two bolts will prevent the carrier assembly from falling.
9. Separate differential carrier from the housing. Be certain carrier is balanced properly on jack, and remove top two carrier-to-housing mounting bolts. Remove differential carrier assembly from the axle housing.

   Mount carrier assembly in a suitable rebuild stand. (Refer to Recommended Service Tools, pg. 22).

Differential Carrier Removal Complete

REMOVAL OF DIFFERENTIAL FROM CARRIER

1. Remove adjusting ring locks from bearing caps.
2. Match mark one differential bearing cap and leg with center punch or chisel for correct reassembly. See Figure 1.

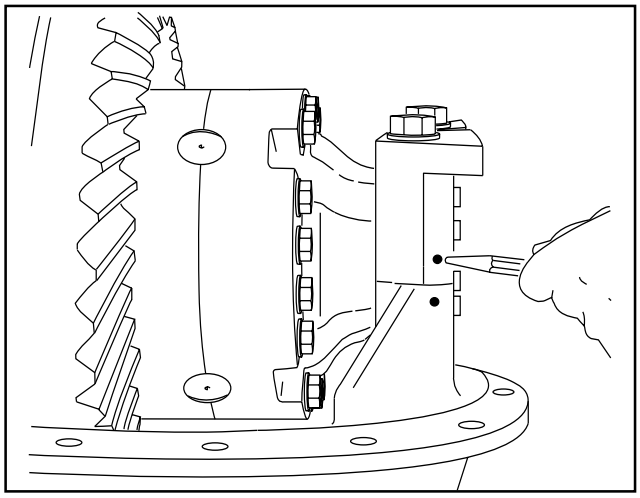


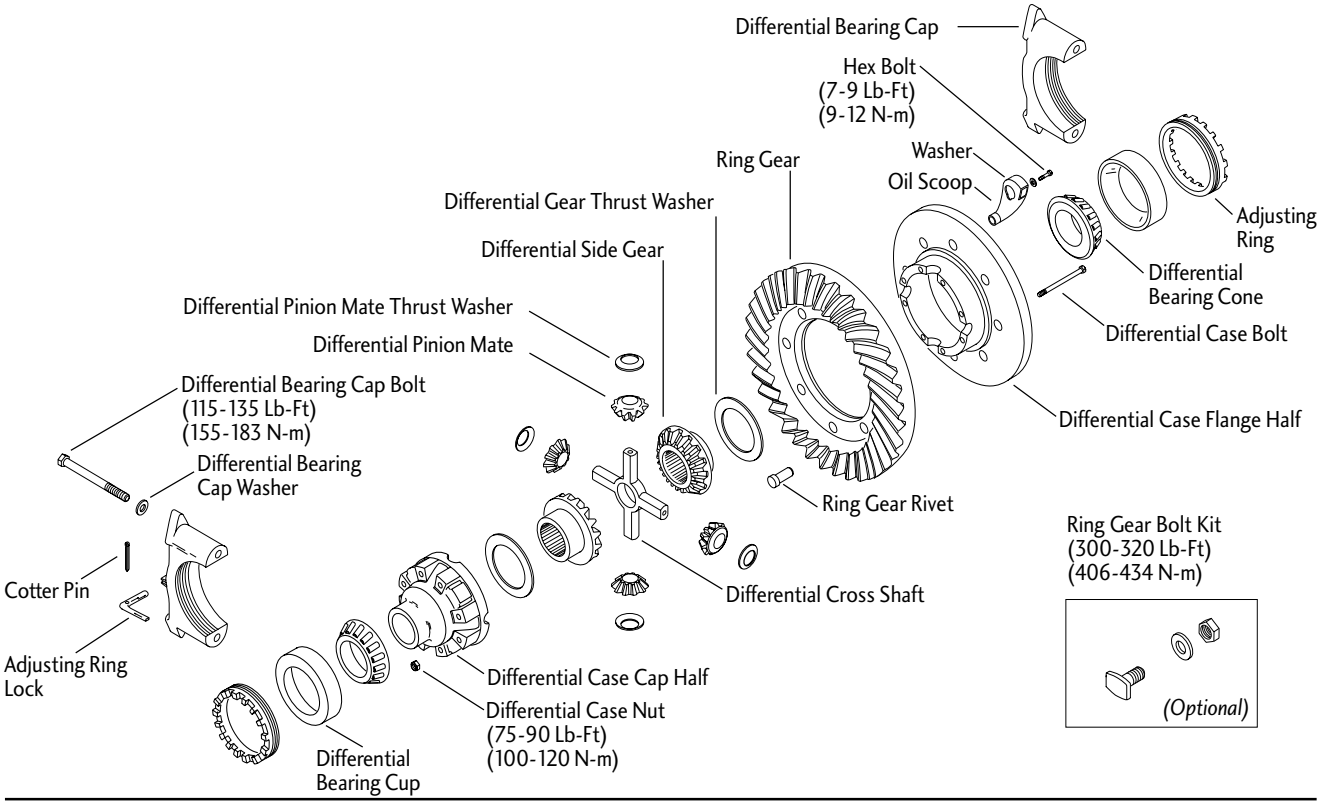
Figure 1

3. Loosen four bearing cap retainer bolts.
4. Loosen adjusting rings, relieving bearing preload.
5. Remove four bearing cap retainer bolts.
6. Remove bearing caps.
7. Remove adjusting rings.
8. Carefully lift the ring gear and differential subassembly out of the carrier.

NOTE: Use care not to damage the ring gear and pinion. If either ring gear or pinion show signs of damage, they must be replaced as a matched set.

Removal of Differential Complete

DIFFERENTIAL DISASSEMBLY



1. Match mark differential case halves with punch or chisel for correct alignment during reassembly. See Figure 2.

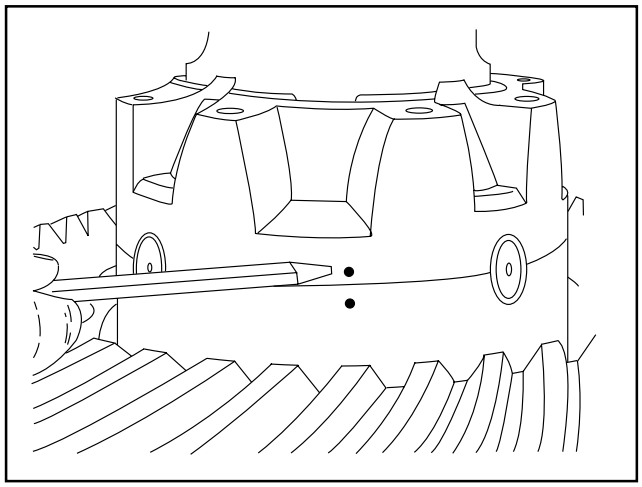


Figure 2

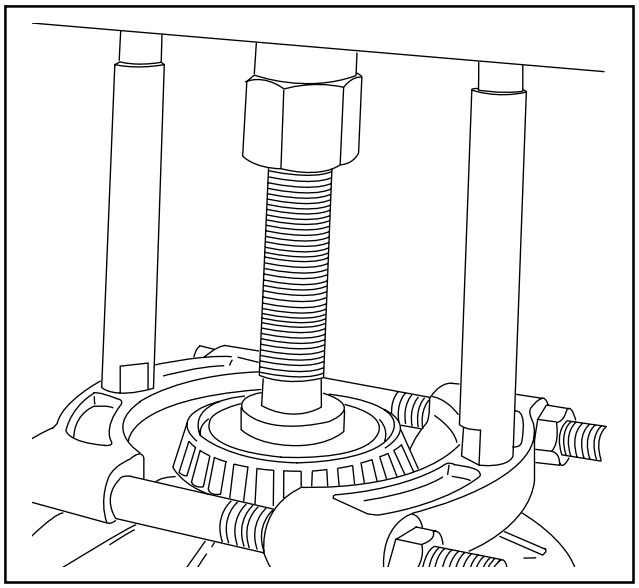


Figure 3

2. Remove differential case nuts and lift off the differential case half.
3. Remove thrust washer and differential side gear.
4. Lift out cross shaft, pinion mates and thrust washer.
5. Remove second differential side gear and thrust washers.
6. If differential side bearings are to be replaced, remove old bearings using suitable puller. See Figure 3.

NOTE: Inspect all parts, including the machined surfaces of the case itself.

DIFFERENTIAL DISASSEMBLY

IMPORTANT: If any gears are to be replaced, they must be replaced in sets. Inspect thrust washers for scoring and excessive wear. Replace all worn or damaged parts.

7. When it is necessary to remove ring gear from differential case, carefully center punch each rivet head. Use a 9/16" drill bit and drill through rivet heads. See Figure 4.

8. Next, use a round type punch to drive out the remaining portion of the rivet.

⚠ CAUTION: Always use a soft hammer or H.D. plastic head hammer to strike punch.

NOTE: Do not use a chisel to remove rivet heads, damage to differential case may result. See Figure 5.

Differential Disassembly Complete

CORRECT PROCEDURE

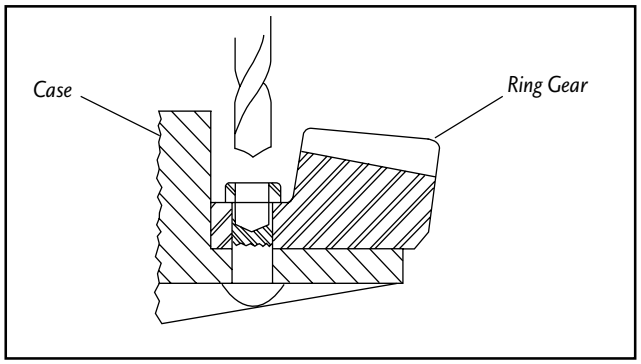


Figure 4

INCORRECT PROCEDURE

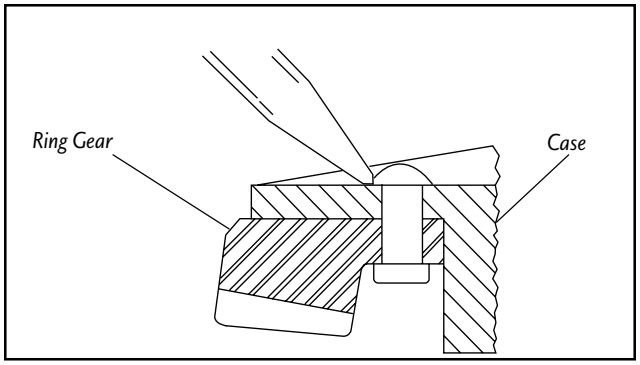


Figure 5

PINOIN ABOVE CENTER APPLICATIONS

The F155-S and F170-S axle assemblies may be specified for pinion above center applications, such as motor homes, buses, or other rear engine chassis vehicles.

The following modifications to the carrier assemblies have been made to insure proper lubrication when axle assembly is mounted with pinion above center.

The F155-S and the F170-S need to have two oil scoops and an additional oil passage in the pinion bearing cage, as shown in the illustration to the right. Mounting screws for the oil scoop must be cleaned and coated with #271 Loctite, or its equivalent. The 3/8 inch oil scoop mounting bolts must be tightened to 34-38 Lb-Ft (46-51 N-m) torque. See Figure 6.

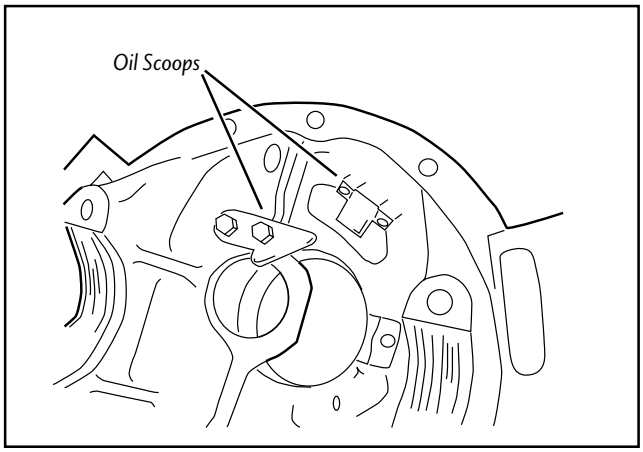
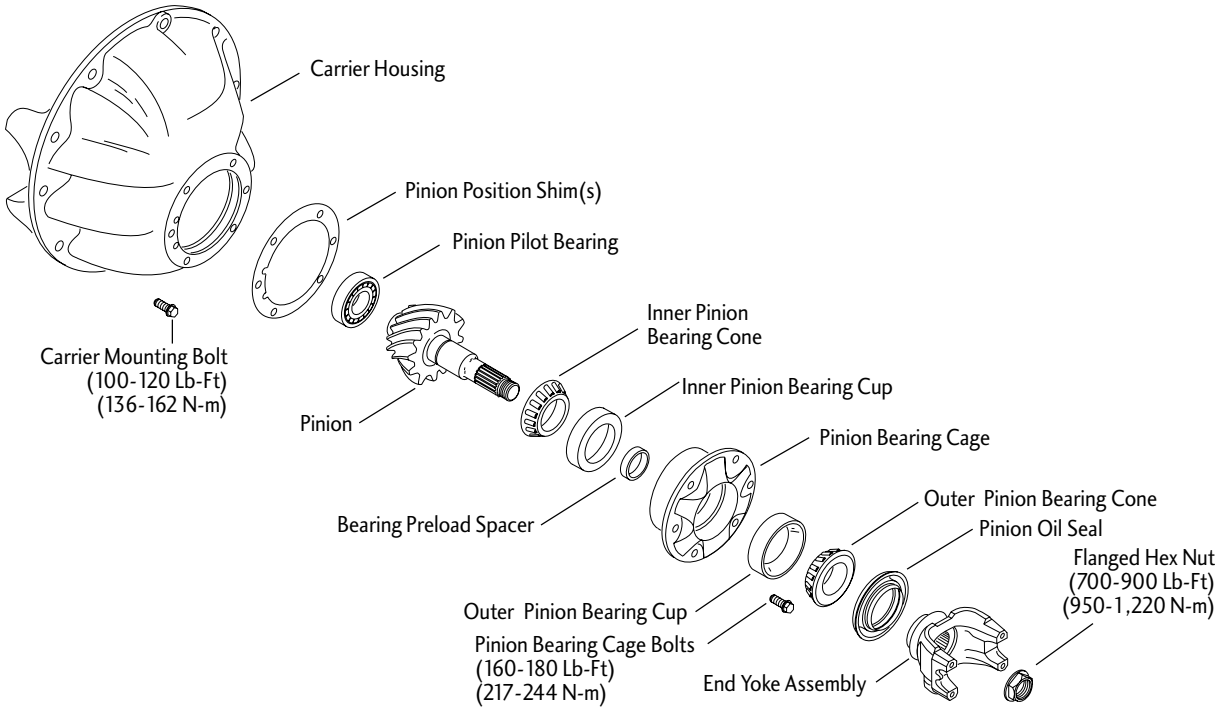


Figure 6

PINION DISASSEMBLY



1. Remove pinion bearing cage mounting bolts.
2. Remove pinion bearing cage and cage assembly from carrier housing. If difficulty is encountered in removing pinion assembly from carrier, place a brass drift on inner end of pinion and tap lightly.

NOTE: Retain shims for possible use during reassembly.

3. Mount pinion assembly in a soft jawed vise or fixture, holding yoke or pinion stationary. Remove roll pin, nut, and spacer.
4. Remove the end yoke or drive gear using a suitable press.
5. Remove pinion from cage assembly.
6. Located between pinion bearings is a selective spacer, used for pinion bearing preload. Retain this spacer for possible use in reassembly.
7. Remove old pinion seal and discard. Always replace it with a new seal at time of reassembly.
8. Lift out the outer pinion bearing cone.
9. Remove inner pinion bearing cup, using a suitable adapter and press or puller.
10. Remove roller bearing from end of pinion.
11. Remove inner bearing cone from pinion.

Pinion Disassembly Complete

CLEANING AND INSPECTION

CLEANING

1. Parts should be cleaned with emulsion cleaners or petroleum base cleaning solvent.

NOTE: Alkaline type solutions may cause damage to machined surfaces and should be avoided.

2. Make sure interior of axle housing is clean prior to reassembly.

3. Clean all gasket surfaces of old material.

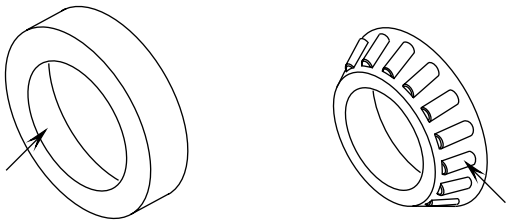
DRYING

Use soft, clean, lintless towels or rags to dry components after cleaning. Bearings should *not* be dried by spinning with compressed air. This can damage mating surfaces due to the lack of lubrication.

After drying, parts should be coated with a light coat of lubricant or rust inhibitor to prevent damage from corrosion. If parts are to be stored for a prolonged period, they should be wrapped in wax paper.

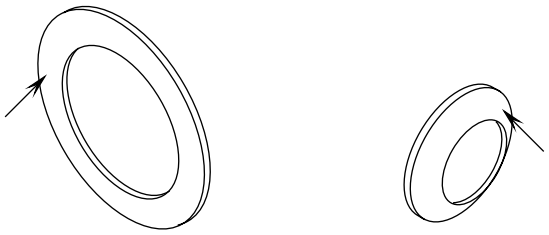
INSPECTION

Prior to reassembly, inspect parts for signs of excessive wear or damage. Replacement of these parts can prevent premature failure and costly downtime.



BEARINGS

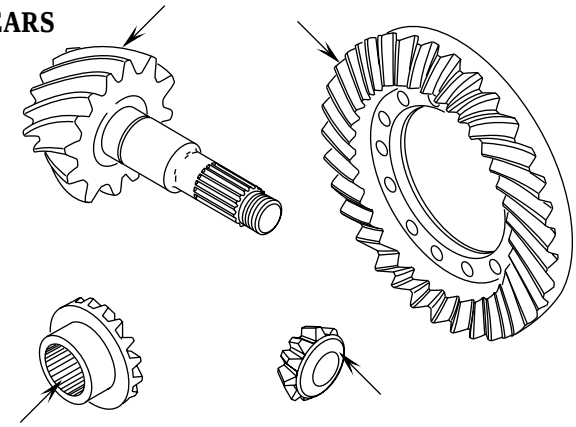
Bearing surfaces should be inspected for pitting, excessive wear, or overheating.



THRUST WASHERS

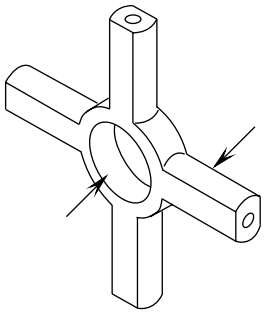
Inspect thrust washers for scoring and cracking.

GEARS



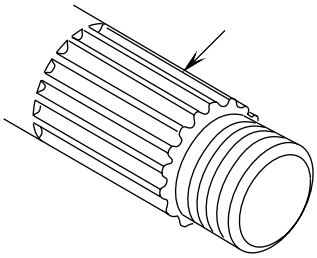
Inspect gears for excessive wear or damage. Replace gears that are pitted, scored, broken, or worn.

SHAFTS



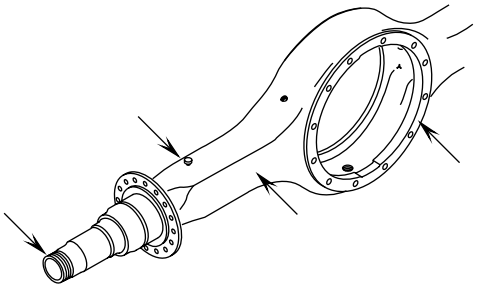
Inspect shafts for nicks or scoring.

SPLINES



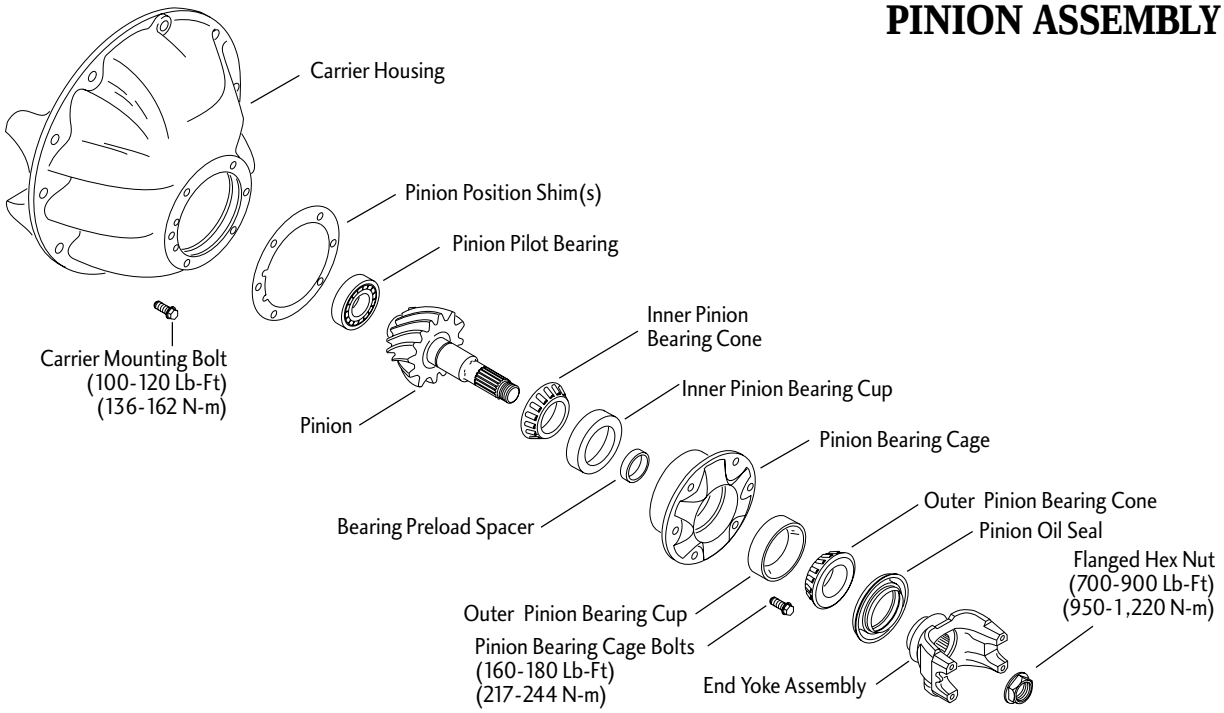
Inspect all splines for excessive wear, distortion from twisting, and cracking.

HOUSINGS



Inspect housing for stripped threads and bending fatigue.

PINION ASSEMBLY



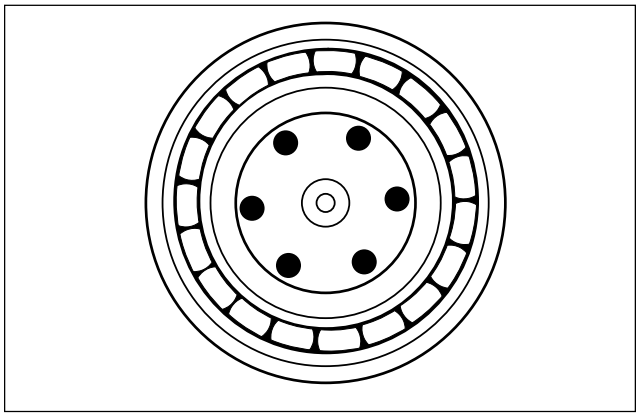
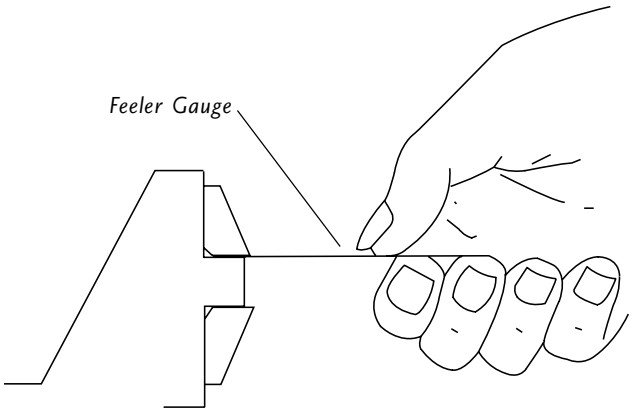


Figure 7



1. Press inner pinion bearing cone onto pinion.
2. Press pinion pilot bearing onto nose of pinion.
3. Stake nose of pinion in 6 places, using a center punch or equivalent tool. See Figure 7.
4. Install inner pinion bearing cup into pinion bearing cage.
5. Install outer pinion bearing cup into pinion bearing cage.
6. Use a feeler gauge or shim stock (.0015 Approx.) to ensure bearing cups are completely seated in bearing bores. This is necessary for proper pinion position.
7. Place pinion bearing spacer, that was removed during disassembly, onto pinion.
8. Place pinion bearing cage onto inner pinion bearing cone.
9. Install outer pinion bearing cone and washer on to pinion.
10. Inspect end yoke or flange for grooves in seal surface caused by contaminants. If grooves can be detected with fingernail, then end yoke must be repaired with a CR approved repair sleeve replaced.
11. Install end yoke onto pinion without seal, to allow proper setting of bearing preload. Torque pinion nut to 700-900 Lb-Ft (950-1,220 N-m) See Figure 8.

PINION ASSEMBLY

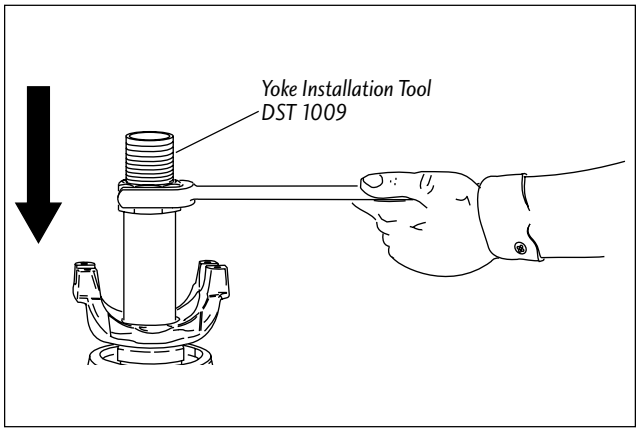


Figure 8

To measure preload with spring scale, clamp the end yoke horizontally in a soft-jawed vise. Attach one end of cord to a bolt hole in the pinion bearing cage and attach the other end of the cord to the spring scale. Rotate pinion cage and attach the other end of cord to the spring scale. Rotate pinion bearing cage by pulling scale. Read scale during fourth revolution. Scale reading must be between 3-9 lbs. See Figure 9.

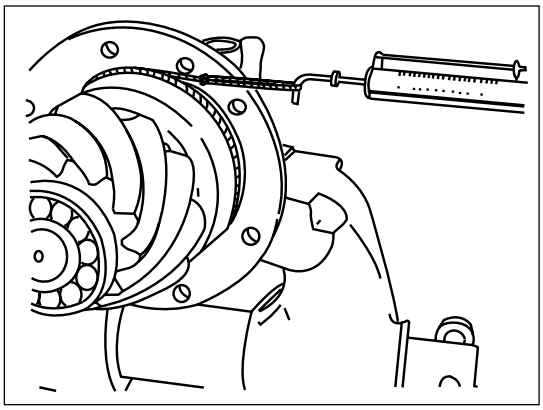


Figure 9

12. Measure torque-to-rotate with an inch-pound torque wrench. Torque measurementsshould be taken every fourth revolution and should read between 10-30 in-lbs of bearing preload. See Figure 10.

NOTE: If bearing preload does not fall within allowed limits, preload can be increased by using a thinner spacer and decreased by using a thicker spacer.

.001" change in preload spacer thickness will change torque-to-rotate approximately 30 in-lbs.

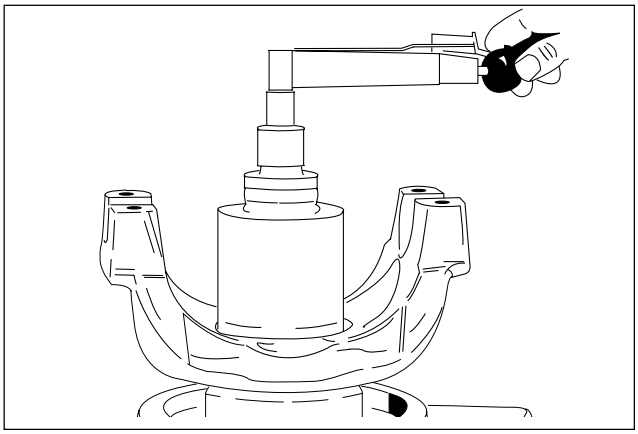


Figure 10

NOTE: Individual carriers may vary slightly.

Pinion bearing preload spacers are available in several thicknesses. Refer to service parts booklet for kits of commonly used preload spacers.

Always measure each spacer before assembly to ensure correct thickness.

NOTE: Closer adjustment can be made by sanding the next thicker spacer to desired thickness using emery cloth on a flat surface.

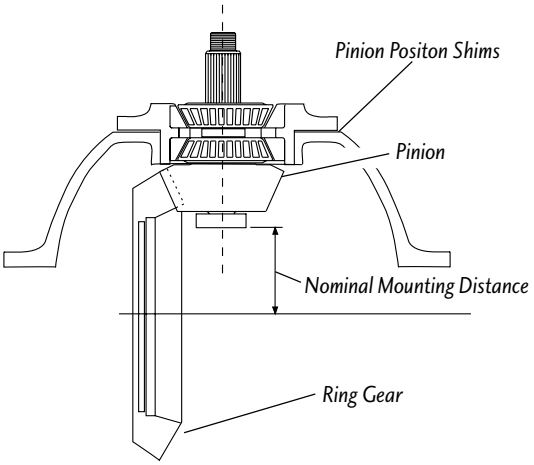
CAUTION: Wash spacer thoroughly of emery cuttings before installing on pinion.

NOTE: Spicer recommends that new torque prevailing nuts be used.

13. Apply Loctite #680(green) to threads.
14. Install new pinion oil seal. Apply a small amount of light greas e to the seal lip. Prior to installing yoke.
15. Use torque multiplier and torque flanged hex nut to 700-900 Lb-Ft (950-1,220 N-m).

Pinion Assembly Complete

Ring gears and pinions are supplied in matched sets only. Matching numbers on both the pinion and ring gear are etched for verification. If a new gear set is being used, verify the numbers of each pinion and ring gear before proceeding with assembly. (See Gear Set Identification, pg. 2)



Pinion position is based on the nominal mounting distance measured from the centerline of the ring gear to the nose of the pinion. This dimension is controlled by selectively shimming between the pinion cage assembly and the carrier housing. The nominal dimension is 3.976 in. (100.990 mm).

NOTE: Be sure mounting surfaces and shims are free of burrs and dirt prior to assembly as they will affect pinion position.

1. To establish the correct nominal dimension by using a pinion setting gauge, install pinion and cage assembly into the carrier housing without shims. Tighten pinion cage bolts to correct torque specifications. (See Axle/Torque Specifications, pg. 21) Failure to tighten properly may result in incorrect gear adjustment.
2. Attach the step plate clamp assembly to the carrier mounting flange. Locate step plate clamp screw over center of pinion. Install step plate under clamp screw and tighten to hold step plate securely in position.

NOTE: Be sure lugs on bottom of step plate straddle the bearing staking indentions on end of pinion, or false reading may occur. Also, make sure differential side bearing bores are clean and free of nicks.

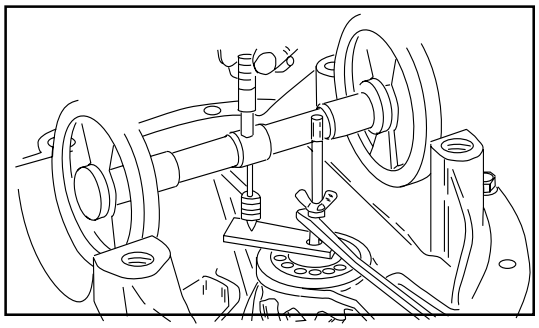


Figure 11

3. Remove any burrs and wipe clean differential bearing bore I.D.'s. Turn micrometer 90 deg. to step plate. Install assembled pinion setting gauge into bearing bores of carrier housing until fully seated. Adjust micrometer so it is directly over end of step plate. Run the micrometer thimble down to measure the distance between the center of the ring gear and the step plate. See Figure 11. Make a note of this dimension.

NOTE: Because the step plate must be taken into consideration, the thickness of the step plate (.400 in. (10.16 mm) needs to be added to the measured value for the correct micrometer distance.

4. On the machined end of each pinion either a plus (+), minus (-), or a zero (0) will be etched. (See Gear Set Identification, pg. 2) This number represents the amount in thousandths of an inch (.001) to be added or subtracted from the nominal dimension for the best running position for that particular gear set.

EXAMPLE:

If pinion is etched +3, the required mounting distance is more than nominal by .003 in. (.076 mm). This means the pinion would require .003 in. (.076 mm) thicker shim between pinion bearing cage assembly and carrier housing that a pinion etched with "0". If the pinion is marked -3, the shim required between pinion gearing cage assembly and carrier housing would be .003 in (.076 mm) thinner than if pinion was etched "0".

PINION POSITION

5. Pinion shims are available in the following thicknesses.

Inches	MM
.005	.127
.010	.254
.030	.762

6. Position shims on carrier housing so oil return holes align properly. Use a minimum of three shims in a pack. If the pack is made of different shim thicknesses, install the thinnest shims on both sides of the pack for maximum sealing.

NOTE: Be sure mounting surfaces and shims are free of dirt and nicks prior to assembly or leaks will occur and pinion position can be affected.

7. Install pinion and pinion cage assembly into carrier.

NOTE: Studs can be used to assist in alignment.

8. Tighten pinion cage to carrier bolts. (See Axle/ Torque Specifications Chart, pg. 21)

9. An alternative to using the pinion setting gauges is to follow the procedure described in the following section.

Pinion Position Complete

PINION SETTING CHART

When a new gear set is being installed, use a micrometer to measure the thickness of the old pinion position shims. Measure each shim separately and add together to get the total thickness of the original build-up.

NOTE: If old shims are bent or mutilated they should be replaced.

If a new gear set is being used, notice the (+), (–) or "0" etching on both the old and the new pinions, and adjust the thickness of the shims to compensate for the difference of these two figures (as shown in table on next page).

For example, if the old pinion is etched +2, and the new pinion is –2, subtract .004 in. from the thickness of the original shims used to position the pinion.

If either or both the pinions are etched beyond the values on this chart, follow the same procedure to establish correct pinion position.

For example if the old pinion is etched –12 and the new pinion is etched +9, add .021 inch to the thickness of the original shims.

After determining the new total build up of pinion position shims, round the figure off to the nearest multiple of .005 inch.

Use the Pinion Setting Chart on the next page as a guideline to set the pinion.

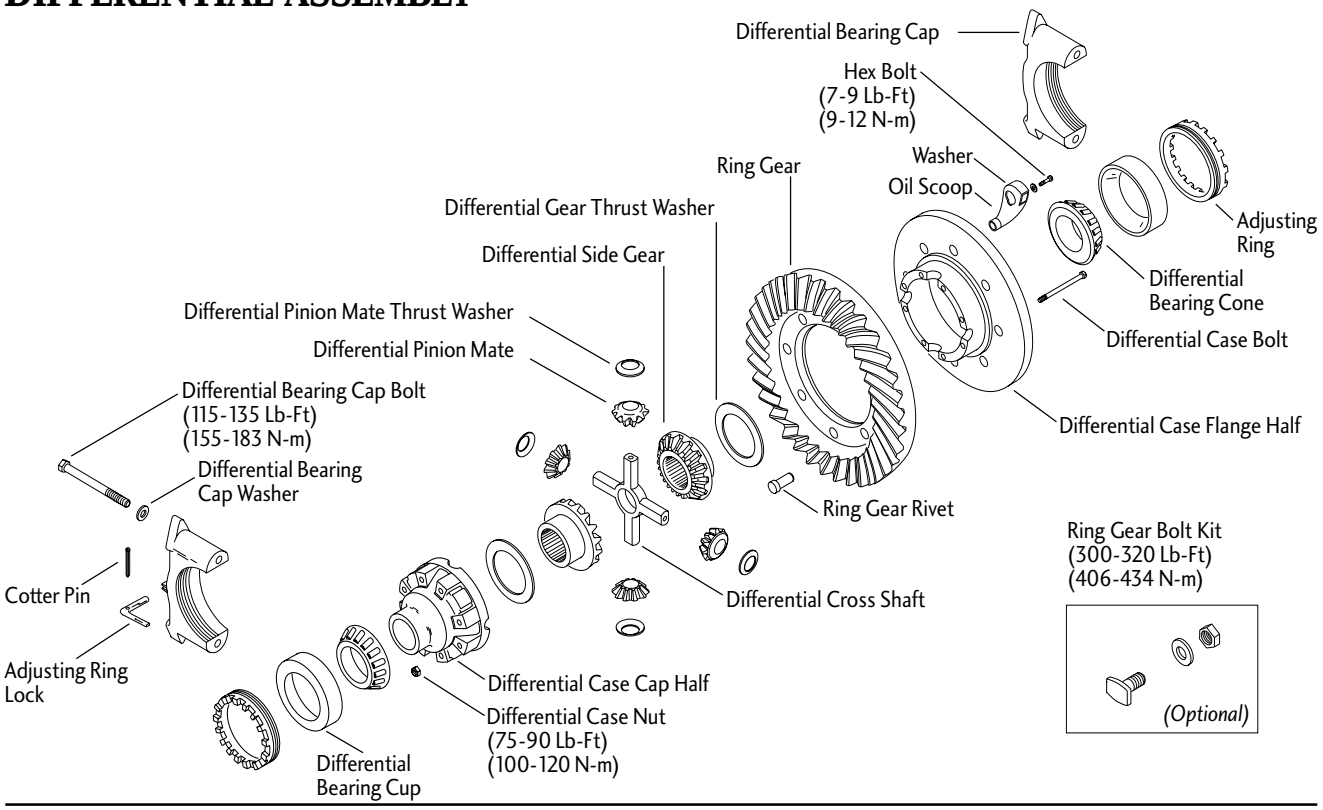
PINION SETTING CHART(OLD TO NEW PINION)

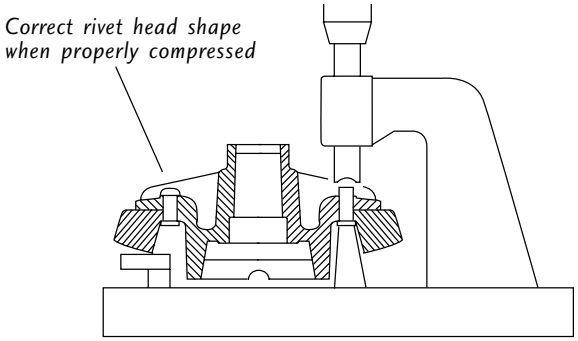
0.000 TOP(INCHES)
.000 BOTTOM(MM)

NEW PINION MARKING

OLD PINION MARKING	-10 M-25	-9 M-23	-8 M-20	-7 M-18	-6 M-15	-5 M-13	-4 M-10	-3 M-08	-2 M-05	-1 M-03	0	+1 M+03	+2 M+05	+3 M+08	+4 M+10	+5 M+13	+6 M+15	+7 M+18	+8 M+20	+9 M+23	+10 M+25
+10 M+25	-0.020 .508	-0.019 .483	-0.018 .457	-0.017 .432	-0.016 .406	-0.015 .381	-0.014 .356	-0.013 .330	-0.012 .305	-0.011 .279	-0.010 .254	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0
+9 M+23	-0.019 .483	-0.018 .457	-0.017 .432	-0.016 .406	-0.015 .381	-0.014 .356	-0.013 .330	-0.012 .305	-0.011 .279	-0.010 .254	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025
+8 M+20	-0.018 .457	-0.017 .432	-0.016 .406	-0.015 .381	-0.014 .356	-0.013 .330	-0.012 .305	-0.011 .279	-0.010 .254	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051
+7 M+18	-0.017 .432	-0.016 .406	-0.015 .381	-0.014 .356	-0.013 .330	-0.012 .305	-0.011 .279	-0.010 .254	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076
+6 M+15	-0.016 .406	-0.015 .381	-0.014 .356	-0.013 .330	-0.012 .305	-0.011 .279	-0.010 .254	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102
+5 M+13	-0.015 .381	-0.014 .356	-0.013 .330	-0.012 .305	-0.011 .279	-0.010 .254	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127
+4 M+10	-0.014 .356	-0.013 .330	-0.012 .305	-0.011 .279	-0.010 .254	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152
+3 M+08	-0.013 .330	-0.012 .305	-0.011 .279	-0.010 .254	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178
+2 M+05	-0.012 .305	-0.011 .279	-0.010 .254	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203
+1 M+03	-0.011 .279	-0.010 .254	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227
0	-0.010 .254	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227	+0.010 .254
-1 M-03	-0.009 .227	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227	+0.010 .254	+0.011 .279
-2 M-05	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227	+0.010 .254	+0.011 .279	+0.012 .305
-3 M-08	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227	+0.010 .254	+0.011 .279	+0.012 .305	+0.013 .330
-4 M-10	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227	+0.010 .254	+0.011 .279	+0.012 .305	+0.013 .330	+0.014 .356
-5 M-13	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227	+0.010 .254	+0.011 .279	+0.012 .305	+0.013 .330	+0.014 .356	+0.015 .381
-6 M-15	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227	+0.010 .254	+0.011 .279	+0.012 .305	+0.013 .330	+0.014 .356	+0.015 .381	+0.016 .406
-7 M-18	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227	+0.010 .254	+0.011 .279	+0.012 .305	+0.013 .330	+0.014 .356	+0.015 .381	+0.016 .406	+0.017 .432
-8 M-20	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227	+0.010 .254	+0.011 .279	+0.012 .305	+0.013 .330	+0.014 .356	+0.015 .381	+0.016 .406	+0.017 .432	+0.018 .457
-9 M-23	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227	+0.010 .254	+0.011 .279	+0.012 .305	+0.013 .330	+0.014 .356	+0.015 .381	+0.016 .406	+0.017 .432	+0.018 .457	+0.019 .483
-10 M-25	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203	+0.009 .227	+0.010 .254	+0.011 .279	+0.012 .305	+0.013 .330	+0.014 .356	+0.015 .381	+0.016 .406	+0.017 .432	+0.018 .457	+0.019 .483	+0.020 .508

DIFFERENTIAL ASSEMBLY





1. If ring gear was removed from the differential case, reinstall it at this time. Bolt ring gear to differential case in two places, 180° apart, before compressing rivet; this will eliminate ring gear runout. Use a hydraulic or mechanical press and riveting fixture. Pressure requirement per rivet is 45-50 tons or (41-45 metric tonnes).

NOTE: Ring gear and pinion must be replaced as a matched set only.

2. Press differential bearing cones onto differential case halves. Place differential bearing cups on cones during remainder of assembly to prevent damage of bearings.
3. Apply a small amount of gear lubricant to all mating surfaces. This will aid in assembly by keeping parts together and providing initial lubrication.
4. Place differential gear thrust washer and differential side gear in differential case flange half.
5. Assemble differential pinion mates and differential pinion mate thrust washers onto differential cross shaft. Place assembly into differential case flange half.
6. Place remaining differential side gear and differential side gear thrust washer in position on differential pinion mates.
7. Assemble case halves, making sure match marks are lined up.
8. Install differential case bolts and torque differential case nuts evenly to 75-90 Lb-Ft (100-120 N-m).

Differential Assembly Complete

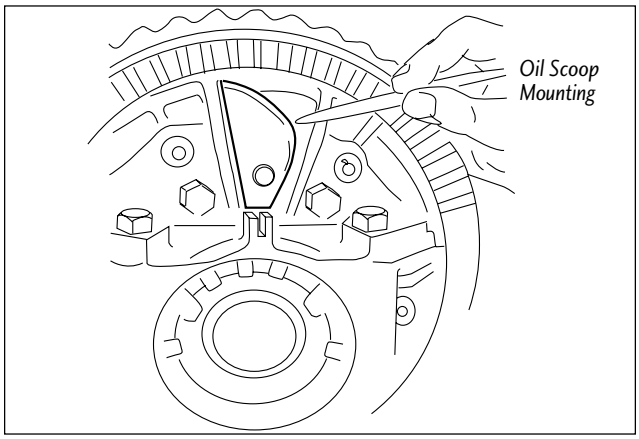


Figure 12

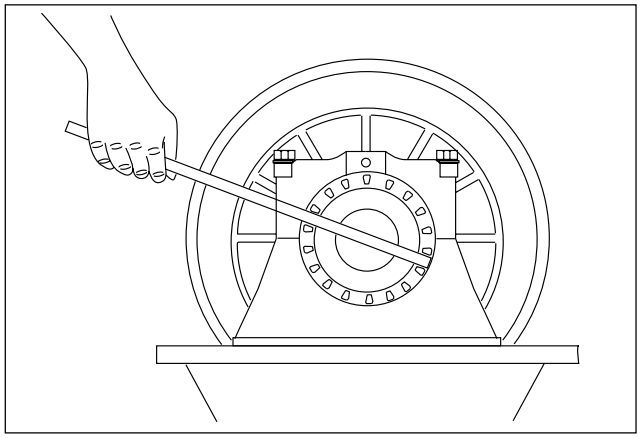


Figure 13

1. Assemble oil scoop onto differential case. See Figure 12. Clean and coat bolts with Loctite #277 or its equivalent. Assemble and torque bolts to 7-9 Lb-Ft (9-12 N-m)

⚠ CAUTION: Differential assembly must be aligned within bearing bores before preload is applied or damage to bearings could occur.

2. Install ring gear and differential assembly into carrier housing. Tilt differential slightly so ring gear clears straddle bearing support.

CAUTION: To avoid damage of the ring gear and pinion, care should be used when installing the ring gear differential assembly into the carrier housing.

3. Be sure side bearing cups are seated on bearing cones. Assemble differential bearing caps, with match marks in proper location. Clean differential bearing cap bolts and washers and coat threads with Loctite #277 or its equivalent. Install bearing cap bolts and tighten enough to eliminate visible space between differential bearing cap and carrier housing. Do not torque the cap bolts at this time.

4. Install adjusting rings. Tighten both adjusting rings until end play is eliminated and there is backlash between the ring gear and pinion. See Figure 13.

5. Loosen adjusting ring on tooth side of ring gear 1 notch and tighten adjusting ring on flange side of ring gear 1 notch. Repeat process until backlash is eliminated. Tighten adjusting ring on tooth side of the ring gear 2 or 3 notches or until proper backlash and side bearing preload are established.

6. Check ring gear and pinion backlash in four equally spaced positions around the ring gear with a dial indicator as shown. Acceptable backlash tolerance is .006"-.012". See Figure 14.

NOTE: If backlash tolerance varies more than .003" (.080 mm) between the four positions, remove the differential and determine the cause.

7. Once backlash is set, torque the differential bearing cap bolts to 115-135 Lb-Ft (155-183 N-m). Check backlash after torquing cap bolts.

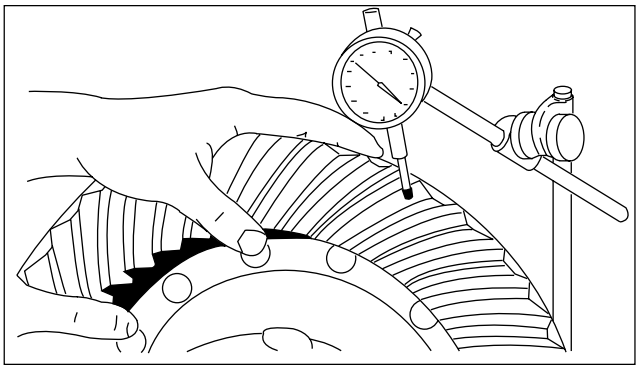


Figure 14

Differential Installation Complete

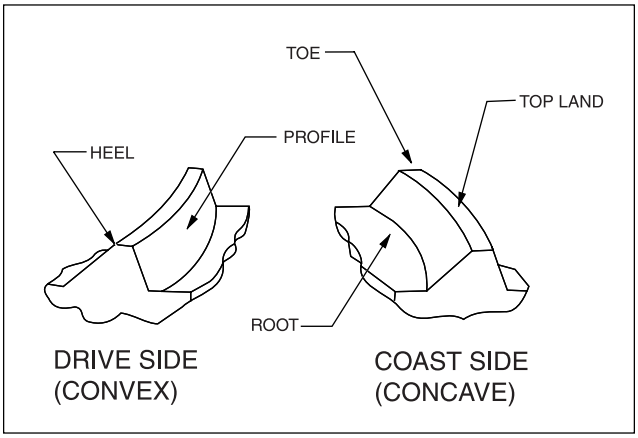
RING GEAR AND PINION TOOTH CONTACT PATTERN

The procedures to the right are to be used to establish proper gear tooth pattern after assembly of the carrier is complete.

NOTE: If matched sets are being reused, measure and record backlash before disassembly, and reassemble to the same backlash. This will match ring and pinion gears to the established wear patterns. Hand rolled patterns will cover less area than the gear pattern established by previous service.

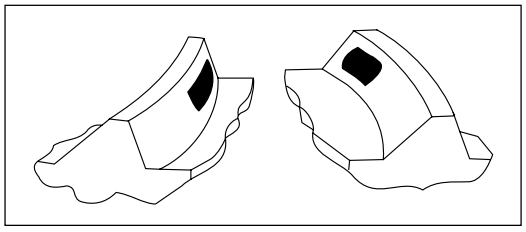
STEP 1. Paint 1/4 ring gear with marking compound on both the drive and coast side.

STEP 2. Rotate ring gear at least one complete revolution in both directions while load is being applied.

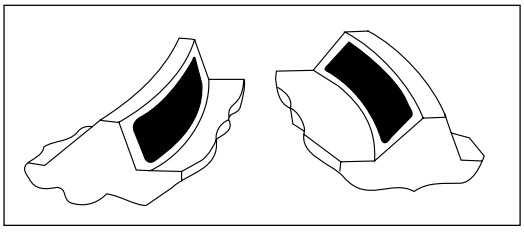


CORRECT GEAR PATTERNS FOR GLEASON CUT GEARS

LIGHTLY LOADED



HEAVILY LOADED

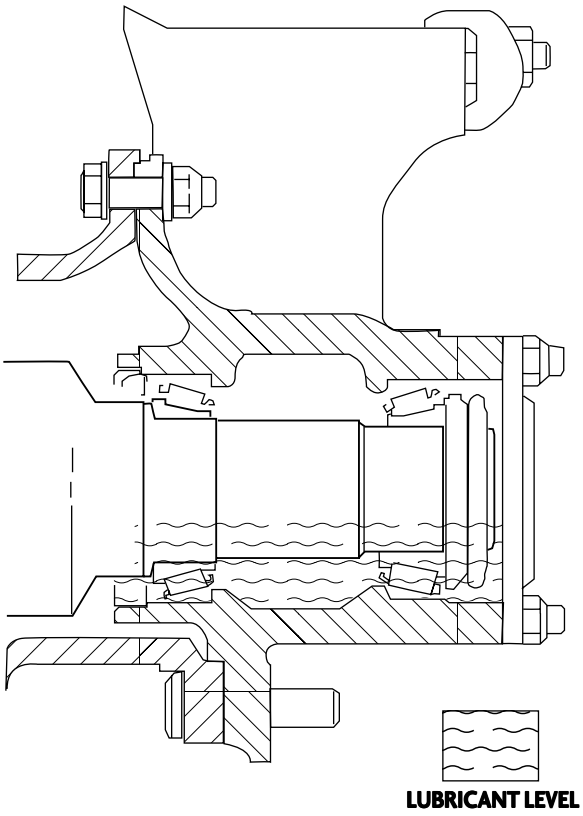


NOTE: Tooth contact pattern, on this axle model, can be moved only by adjusting backlash. The contact pattern can be moved in the direction of heel-to-toe, and toe-to-heel; Depth of the pattern cannot be adjusted. If an acceptable tooth contact pattern cannot be established within limits of backlash, contact Spicer Service at 1-800-666-8688.

WHEEL BEARING ADJUSTMENT

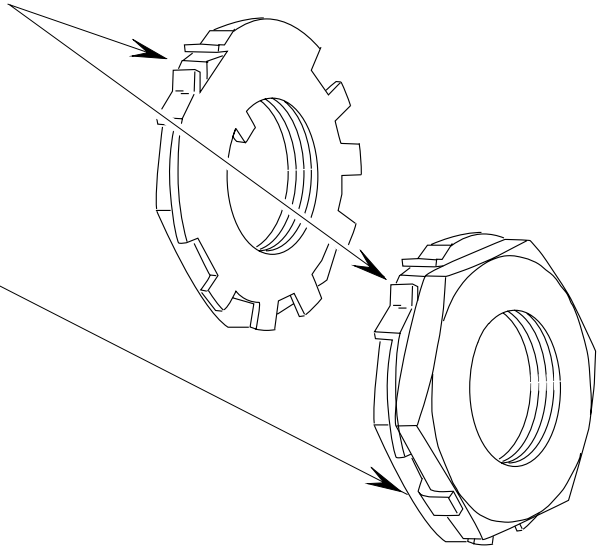
NOTE: Wheel bearings should be adjusted following vehicle manufacturers recommended maintenance schedule.

1. Block wheels not being adjusted to insure that vehicle will not roll. Release emergency brake.
2. Raise wheel to be adjusted off of the ground. Make certain wheel rotates freely.
3. Remove axle shaft.
4. Remove outer adjusting nut and lock if tabs are broken.
5. Torque inner wheel nut to 50 Lb-Ft (68 N-m) while rotating wheel one direction, then the other direction. Back off inner nut 1/4 turn.



NOTE: When replacing wheel bearings, new bearings must be re-seated to insure maximum service reliability. After the hub and bearings are assembled in place on the spindile, install the inner adjusting nut. Tighten the inner adjusting nut to 120 - 140 Lb-Ft (163-190 N-m), while rotating the hub to seat the bearings. Back off the adjusting nut 1/2 turn and follow the proedure outlined in step #5.

6. Install lock against inner wheel nut, with locking portion positioned on either the flat side of inner nut or peak of inner nut, as shown.
7. Install outer wheel nut and torque to 250-275 Lb-Ft (340-373 N-m). Rotate wheel in both directions. Wheel must rotate freely, with out binding.
8. Bend one tang of lock over flat portion of outer wheel to secure.
9. Remove old axle flange gasket and clean mating surfaces of hub and axle flange.
10. Install new axle flange gasket.
11. Install axle shaft. Torque axle nuts to specifications. (See Axle/Torque Specifications, pg. 21)



INSTALLATION OF DIFFERENTIAL CARRIER INTO AXLE HOUSING

1. Thoroughly clean the inside of the carrier housing and inspect the housing mounting surface for nicks and general cleanliness. Stone the surface if necessary to remove burrs or nicks. Bolt holes must also be checked, to see that they are free of contaminants.

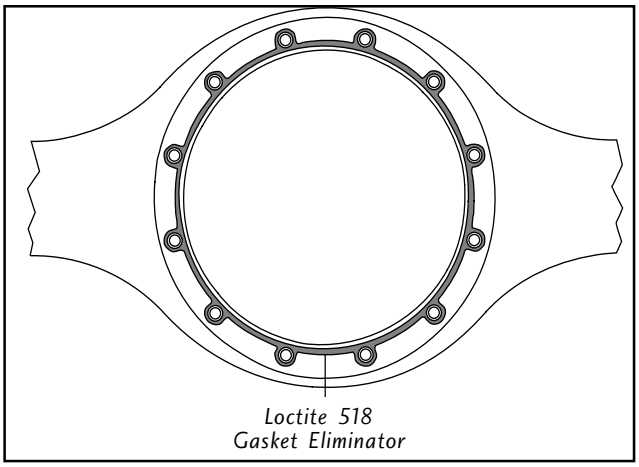
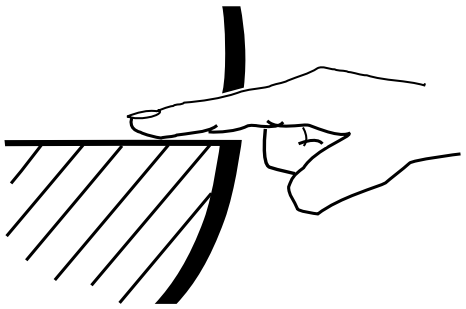


Figure 15

2. Apply an .125 inch (3.175 mm) diameter bead of Loctite #518 gasket eliminator onto the axle housing mounting flange and around each bolt hole. See Figure 15.
3. Thread two studs into the axle housing 180^0 apart. This will eliminate rotation of the carrier assembly after it makes contact with the gasket material.
4. Install the carrier assembly into the axle housing. If reinstalling used bolts, clean the mounting bolts, and coat with Loctite #277, and install. Tighten bolts evenly in a crossing pattern. Torque bolts 100-120 Lb-Ft (136-162 N-m).
5. Allow one hour cure time for gasket material before adding hypoid gear lubricant.
6. Remove the old axle flange gasket and clean mating surfaces of the hub and axle flange.
7. Install the new axle flange gasket.
8. Install the axle shafts to proper location. Torque the axle flange nuts to vehicle manufacturers specifications.
9. Clean drain plug and install. Torque drain plug to 35-45 Lb-Ft (47-61 N-m). Fill unit to proper level with hypoid gear lubricant.
10. Install fill plug and torque to 35-45 Lb-Ft (47-61 N-m).



NOTE: Lubricant close enough to bottom of fill hole to be seen or touched is not sufficient. Lubricant must be level with the fill hole.

Model	Pints	Liters
F155-S & F170-S	23	11

** Lube capacity will vary depending upon the housing angle in each vehicle. Capacities given above are for an angle of 4 degrees. Fill to the lower edge of the fill hole in the axle housing as shown above.*

*** Pour 1 Pint (0.5 Liter) of gear lube into the filler hole in top of Inter-axle Differential cover.*

Hex Head Fasteners

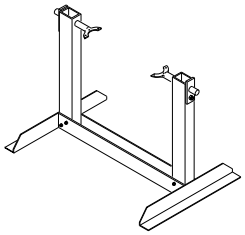
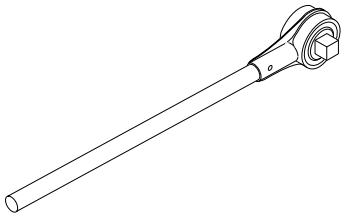
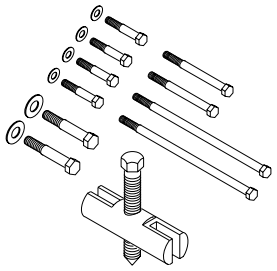
Position	Thread	Grade	Lb-Ft	N-m
Flanged Hex Nut	1-3/4" - 12	8	700 - 900	950 - 1,220
Pinion Bearing Cage Bolts	9/16" - 12	8	160 - 180	217 - 244
Differential Bearing Cap Bolts	9/16" - 18	8	115 - 135	155 - 183
Differential Case Nuts	1/2" - 13	8	75 - 90	100 - 120
Carrier Mounting Bolts	1/2" - 13	8	100 - 120	136 - 162
Differential Case Oil Scoop Bolts	1/4" - 20	8	7 - 9	9 - 12
Axle Flange to Wheel Hub Nuts	9/16" - 18	5	95 - 115	129 -155

Axle Specifications

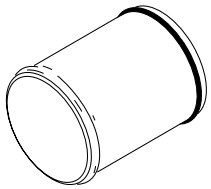
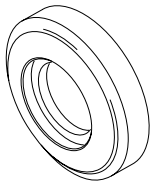
Item	U.S.	Metric
Pinion Bearing Preload*		
Pull Scale	3 - 9 Lbs	1.4 - 4.0 Kg
Torque Wrench	10 - 30 Lb-in	1.1 - 3.4 N-m
Differential		
Ring Gear to Pinion Backlash	.008" - .012"	.23 - .33 mm
Ring Gear Rivet Pressure	45 - 50 tons	41 - 45 tonnes
Lubrication		
Lube Capacity (Approx.**)	23 pints	11 liters
Pinion Nominal Dimension	3.4725"	88.20 mm

** Pinion bearing preload is established prior to installation of pinion seal.*
*** Capacity will vary depending on the housing angle in each vehicle. Fill to lower edge of fill hole in rear of axle housing as shown on page 3 .*

RECOMMENDED SERVICE TOOLS

ORDER NUMBER	ILLUSTRATION	DESCRIPTION
DST1001		CARRIER STAND
DST1002 DST1003 DST1004 DST1005		TORQUE MULTIPLIERS Maximum 1,000 Lb-Ft Maximum 2,000 Lb-Ft Maximum 4,000 Lb-Ft Maximum 12,000 Lb-Ft
DST1006		YOKE REMOVER, BAR TYPE

RECOMMENDED SERVICE TOOLS

ORDER NUMBER	ILLUSTRATION	DESCRIPTION
DST1000-1		SEAL INSTALLATION TUBE HANDLE
DST1020		PINION SEAL INSTALLER

ALL SERVICE TOOLS AVAILABLE FROM OTC DIVISION:

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655 Eisenhower Drive
Owatonna, MN 55060
Telephone: 1-800-533-0492
Fax Number: 1-800-578-7375

NOTES

NOTES

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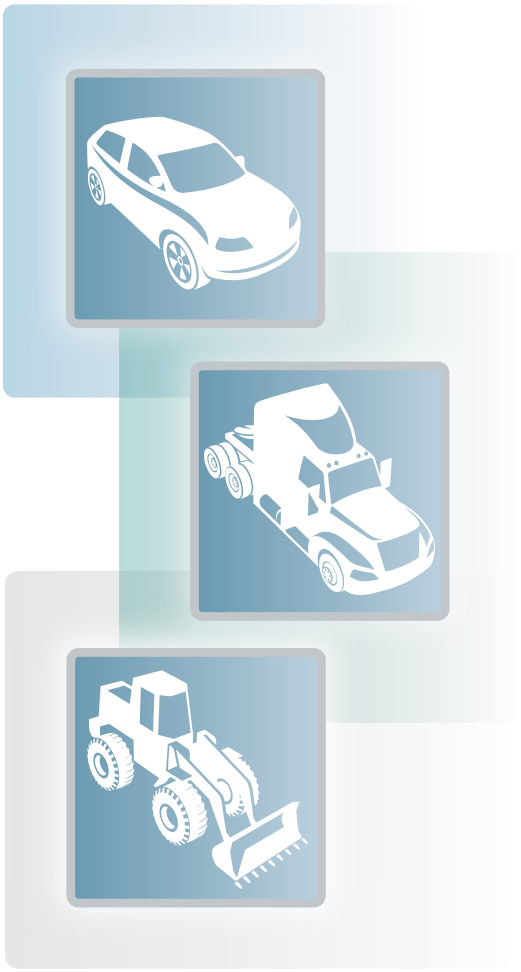

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